Binary Search Cheatsheet

Use this algorithm when:

- If X works, x+1 is guaranteed to work, and if x fails x-1 is guaranteed to fail

- OR -

- If X fails, x+1 is guaranteed to fail, and if x works x-1 is guaranteed to work

Steps to using the algorithm:

Thinking about the problem:

1) Decide the lower bound and the upper bound
2) Figure out how to solve the works function
    a) “Restart” solving the problem with the simplified problem, ignore the original problem
    b) If this is a sweep, refer to the sweeping cheatsheet

Implementation (pick one of these two and set the lower bound, set the upper bound, and write the works function:

```
// Smallest value x that works
int a = lowerbound, b = upperbound;
while (a != b) {
    int mid = (a+b)/2;
    if (works(mid)) {
        b = mid;
    }
    else {
        a = mid+1;
    }
}
// Largest value x that works
int a = lowerbound, b = upperbound;
while (a != b) {
    int mid = (a+b + 1)/2;
    if (works(mid)) {
        a = mid;
    }
    else {
        b = mid-1;
    }
}
```

How to calculate the runtime:

O(logN * (runtime of the works function))